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From: Commanding Officer, Navy Personnel Research and Development Center

Subj: **PROCESS RESTRUCTURING AS A MEANS FOR IMPROVING AN AIRCRAFT OVERHAUL PROGRAM**

Encl: (1) NPRDC TN 88-21

1. Enclosure (1) is submitted for your information and retention.

2. This technical note presents a description of a project carried out at the Naval Aviation Depot (NAVAVNDEPOT), North Island, California. The central objective was the redesign of the F-14 overhaul process. As part of the program assessment, the Navy Personnel Research and Development Center (NAVPERSRANDCEN) was requested to document, in case study format, the changes and their effects on organizational functioning. Their work was supported by Program Element 63739N-T1886: Methods for Managing Quality Improvement in Navy Maintenance Activities.

3. Since the fall of 1984, NAVPERSRANDCEN has been involved in the total quality management (TQM) effort at NAVAVNDEPOT, North Island. NAVPERSRANDCEN's work there has included the development and presentation of training in TQM philosophy and basic graphic techniques, facilitation of project teams, consultation regarding implementation strategies for managers, the development of measurement techniques, and the assessment of the organizational impacts of the TQM effort. The case study presented in the report exemplifies the TQM principles adopted by the organization.

4. Appreciation is expressed to CAPT Thomas O'Connor, Commanding Officer of NAVAVNDEPOT, North Island, for his cooperation and support. The authors would also like to thank William Hines, Charles T. Omelina, and Charlie Ross for their time and effort in providing information regarding the project.

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Process Restructuring as a Means for Improving an Aircraft Overhaul Program

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This case study describes improvements in F-14 aircraft overhaul at a naval industrial facility that resulted from a team's analysis and redesign of work processes. The team revised and optimized the overall work plan for F-14 overhaul based on information obtained through the disassembly of a test aircraft by skilled artisans. Paperwork that directs the overhaul was modified to reflect changes in the work processes, and general housekeeping was performed in the aircraft disassembly areas. Benefits of the team's efforts included improvements in the work processes that enabled artisans to perform their jobs more easily and efficiently and improvements in the overall efficiency of the F-14 overhaul program, leading to reduced turnaround time. The case study demonstrates the value of focusing on process analysis and restructuring to improve an overall operation, the types of process improvements that can lead to better outcomes, and the role of management in supporting such an effort.

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SUMMARY

Purpose

The case study reported here describes how product quality and productivity improved through optimization of work processes at a naval industrial facility. The purposes of the report are to demonstrate the value of focusing on process to improve an overall operation, to describe the process changes proposed and implemented, and to develop a better understanding of the role of management as a provider of support, guidance, and resources for such an undertaking.

Approach

In response to difficulties noted in overhauling F-14 aircraft efficiently, a team was formed to analyze and redesign the F-14 overhaul process.

The team disassembled a test aircraft and recorded the actual steps taken by skilled artisans to perform the work. This information served as the foundation for revised work procedures within the overhaul process and was used to optimize the overall work plan for F-14 overhaul. The approach taken by the team was fairly straightforward and consisted of three major activities: (1) the work processes involved in the overhaul of the F-14 were analyzed and redesigned, (2) the team modified the paperwork that directed overhaul so that it reflected the changes in work processes, and (3) general housekeeping was performed to put work areas in order and to eliminate the chaos caused by planes stacking up due to missed schedule.

Benefits

The efforts of the team produced two types of benefits: (1) **process improvements,** such as less paperwork and a reduction in time to evaluate and route parts to processing shops, which, in turn, enabled artisans to perform their jobs more easily and efficiently; and (2) **outcome improvements,** such as reduced turnaround time, which enhanced the overall efficiency of the F-14 overhaul program. Artisans, managers, and support groups report improved working conditions due to greater control over work procedures and the ability to meet the schedule efficiently.

Conclusions

The information presented in this case study serves to demonstrate the usefulness of process improvement, the types of changes that can have an impact on process outcomes, and the role of management in carrying out such an effort. The information is also useful to other organizations faced with similar problems.

CONTENTS

LIST OF FIGURES

INTRODUCTION

Civilian industrial facilities that support military activities fill a vital yet difficult role. Tasked with meeting military needs, they must provide a variety of services during peacetime, be prepared to provide support during mobilization, and efficiently perform these services under the close scrutiny of Congress and other governmental organizations. One such facility is the Naval Aviation Depot (NAVAVNDEPOT) at North Island in San Diego, California. NAVAVNDEPOT, North Island is a complex facility with a varied product mix whose mission is to provide expert aircraft, engine, and aviation equipment overhaul, maintenance, and repair. As with all other government organizations, it is faced with the challenge of trying to increase the quality of its products with fewer resources. Adopting the stance taken by other organizations in both the private and public sectors, NAVAVNDEPOT, North Island is turning toward improving the quality of its products and services through monitoring and improving its work processes and procedures.

This case study, prepared by the Navy Personnel Research and Development Center (NAVPERSRANDCEN), describes an effort to improve product quality and productivity through optimization of work processes at a naval industrial facility. The focus of the effort was the reorganization of the work processes involved in the overhaul of F-14 aircraft. The effort was known as the GTST ("G-test") project. The "G" refers to the first symbol in the induction sequence number for F-14 aircraft at NAVAVNDEPOT, North Island and "TST" is short for "test," referring to the testing and analysis of work processes in F-14 overhaul. This case study provides a good example of the payoffs that accrue when analyses of work processes and changes in work procedures are employed to optimize those processes. It also provides insight into the types of changes in work processes that result in improved product quality and process efficiency. Finally, the case study exemplifies the role of management and the importance of its support and commitment to the success of a process improvement effort.

BACKGROUND

The GTST project was conducted at NAVAVNDEPOT, North Island, which has been involved in the implementation of a total quality management (TQM) effort throughout the organization for the past 3 years. While the GTST project was not a formal part of the TQM effort at that facility, the approach taken by the project team is consistent with TQM and thus had top management's full support. Management provided the climate within which GTST could be tested by giving the people on the GTST project the resources and autonomy necessary to modify work processes.

Briefly, NAVAVNDEPOT, North Island's TQM effort is reflective of the TQM philosophy espoused by its parent organization, Naval Air Systems Command (NAVAIR-43). According to the Command definition, TQM is the application of quantitative methods and human resources to control and improve (1) materials and services supplied to the company, (2) the process resulting in products and services of the company, and (3) meeting the needs of the customer (see Figure 1). The GTST project focused on the second component, the improvement of a process leading to a product.

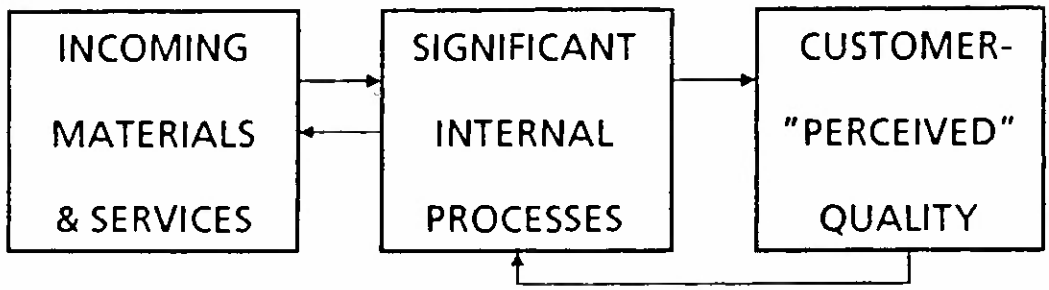

Figure 1. Major components of a total quality management effort.

Description of the F-14 Overhaul Program

The primary focus of the GTST project was an examination and modification of the work processes required for scheduled overhaul of F-14 aircraft. Typically, after 48 months in service, aircraft are disassembled, evaluated, and brought back to like-new operating condition. Unscheduled repairs may be required due to failures of aircraft systems or damage from operation (e.g., from fire, rough landings). The GTST project concentrated on the processes required for scheduled overhaul, with the knowledge that improvements in the overhaul process might enhance the system through which both scheduled and unscheduled maintenance is performed.

The advanced technology of the F-14 and changes in processing requirements have demanded changes on the part of personnel at the NAVAVNDEPOT in planning for processing as well as in the actual overhaul work. These changes have resulted in increased demands on artisans, mechanics, and support groups to adapt to new aircraft technology and work procedures.

The processing work plan for the F-14, adapted from one developed at one of the other five NAVAVNDEPOTs, involves four major phases: (1) disassembly, (2) metal/modification, (3) assembly/final, and (4) test line. The disassembly phase consists of removal of components from the aircraft and their routing to shops for overhaul, x-ray inspection of structural parts, and a determination of necessary repairs to the aircraft structure. The metal/modification phase includes the actual repair of the aircraft structure, including necessary metalwork. The assembly/final phase is comprised of the reassembly of all new and reworked components, and the test line phase involves ground and flight checks and final painting of the aircraft. This work is scheduled to be performed at NAVAVNDEPOT, North Island in 177 days. The F-14 program manager at the NAVAVNDEPOTs negotiates this turnaround time for 4-year periods, and induction schedules are based on that turnaround time.

Problems in Processing

Problems were associated with the processing of F-14s from the beginning. Management at NAVAVNDEPOT, North Island had attempted to address these difficulties by identifying areas that might be causing the problems and assigning teams to work on

them. Teams were formed to study the issue of control over attaching hardware (e.g., nuts, bolts) and design of proper paperwork to guide and document processing for F-14 overhaul. Although attempts were made by the teams to address these problems, they reached an impasse.

At this point, a team member from the Long Range Material Planning Department and the F-14 program manager met and decided that a larger commitment was necessary in order to address the difficulties with the F-14 process. They felt that this larger commitment in the short term would yield long-term payoffs for the program. The two developed a proposal for studying the F-14 system.

Their plan had several components. First, they proposed taking the radical step of halting further induction of F-14s and subjecting the processing plan for F-14s to a complete review and modification. Second, they proposed that one team be assembled to address the issue of F-14 processing in its entirety, and that the members of this team should be relieved of their regular work duties to devote full time to the F-14 project. Third, they requested that the project be assigned a separate physical location in which the entire team could meet and disassemble an F-14. After considering the proposal and the anticipated organizational impact of such an endeavor, top management approved the plan and gave its commitment and support. A team of experienced individuals from a variety of departments was assembled to address the F-14 issue. One aircraft, sequence numbered "G562," was identified as the aircraft to be used for this effort.

The GTST Team

The GTST team was comprised of 33 people from various production and support departments. The driving force behind the project were the individuals who had proposed the GTST project to top management (the F-14 program manager and the long-range material planner) and a production foreman from the F-14 assembly area. The other team members were selected for their knowledge of production and support issues that impact F-14 processing. The team members and the work units they represented are presented in the Appendix.

All members of the team were temporarily relieved of their regular job responsibilities in order to devote full time to the GTST project. The team was given space in a hanger in which to perform its activities. The team was given not only the responsibility of determining what process improvements should be made, but also the authority to enact those changes that they felt were necessary.

APPROACH

The approach taken by the GTST team involved three major activities: (1) the work processes involved in the overhaul of the F-14 were analyzed and redesigned, (2) the paperwork that directed aircraft overhaul was modified so that it reflected changes in work processes, and (3) general housekeeping was performed to put work areas in order and to eliminate the chaos caused by planes stacking up due to missed schedules. This activity took place in the disassembly phase of the F-14 overhaul program.

Of primary concern to the GTST team was the fact that the work plan for F-14 overhaul, as reflected in the processing paperwork, did not adequately direct and support the actual work performed. In order to better understand the integration of the processing paperwork and the actual work procedures, the team decided to first focus on

the actual work sequences by using a "hands on" approach to analyze all of the operations and processes required to overhaul an F-14.

ANALYSIS AND REDESIGN OF WORK PROCESSES

The GTST team was concerned with identifying those work processes and operations that would lead to efficient and high quality F-14 overhaul. Further, when the team members identified the optimal work procedures, they wanted to be assured that all personnel would utilize the same system for the overhaul of aircraft and would have the necessary information and materials to perform the job.

Disassembly for GTST

As a first step, experienced artisans on the team disassembled the F-14, and the various steps in the disassembly process were recorded. The work sequences or operations for disassembly identified by the artisans were based on their conception of the simplest and most direct way of performing F-14 disassembly. Disassembled parts, components, and attaching hardware were grouped according to the sequence in which they were removed from the aircraft and placed in containers. A container was assigned for each operation. The systematic fashion in which the disassembly was accomplished provided the team with a clear conceptualization of the nature and ordering of the essential operations that make up the overhaul process. Those operations were then used as the basis of reorganizing the work flow throughout all phases of F-14 processing.

Recycling of Hardware

The systematic disassembly was instructive with respect to the issue of attaching hardware: (1) artisans and managers discovered that a larger percentage of hardware was reusable than had been presumed; (2) the physical steps necessary for conserving this hardware involved less time and effort than they had anticipated; and (3) recycling the hardware actually facilitated work at later stages of overhaul. Prior to GTST, some attaching hardware was saved; however, much of it was discarded or misplaced after removal in disassembly. In some cases, the hardware was needed in the assembly area at a later point in time, but since it was not adequately organized or labeled, artisans could not use it again. This required ordering new hardware for assembly (some items costing several hundred dollars) and resulted in delays that slowed the assembly process considerably. After the GTST project, hardware removed from the aircraft was evaluated and catalogued for future reassembly. A store of parts was established in disassembly, and, in those cases where parts could not be reused, they were replaced.

Modifying the Work Flow

The recording and analysis of steps in the disassembly process permitted the GTST team to identify the most efficient way to perform disassembly and to organize F-14 overhaul. While most changes were at a detailed level and involved specific operations within the overhaul process, some modifications affected the overall overhaul process. Although the general sequence of aircraft overhaul is for the most part fixed (e.g., disassembly precedes assembly), the team found that they could make some improvements in that sequence. These changes were made to make the work plan correspond more closely to the actual work procedures required to overhaul the F-14.

The overall work flow as it was originally designed and the changes that were introduced as a result of the GTST project are presented in Figures 2 and 3. The 177-day work schedule is depicted. The number of days for completion of each activity is given in parentheses below each activity name. In the post-GTST work flow, the disassembly phase incorporates more work activities (i.e., Phase I and Phase II disassembly) and a longer period of time scheduled to complete them. The additional work procedures that are performed in the disassembly phase (e.g., pre-kitting of materials) lead to streamlined work procedures in subsequent phases of the overhaul process. Examples of changes in processing sequence shown in Figures 2 and 3 include the separation of electrical and hydraulic functions. Since electrical power was needed only for canopy rig, the electrical and hydraulic functions could be separated and performed simultaneously, thus making the process more efficient. Similarly, the flight control rig procedures were moved in the sequence of work processes, and the amount of time required to perform the procedures was reduced from 13 to 9 days.

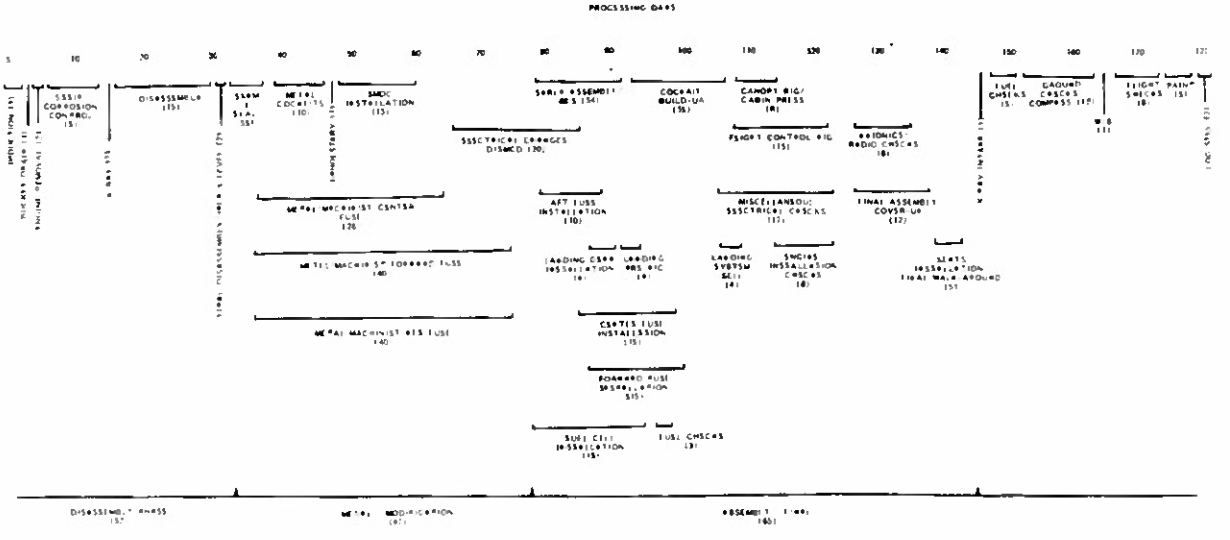

Figure 2. Pre-GTST work flow.

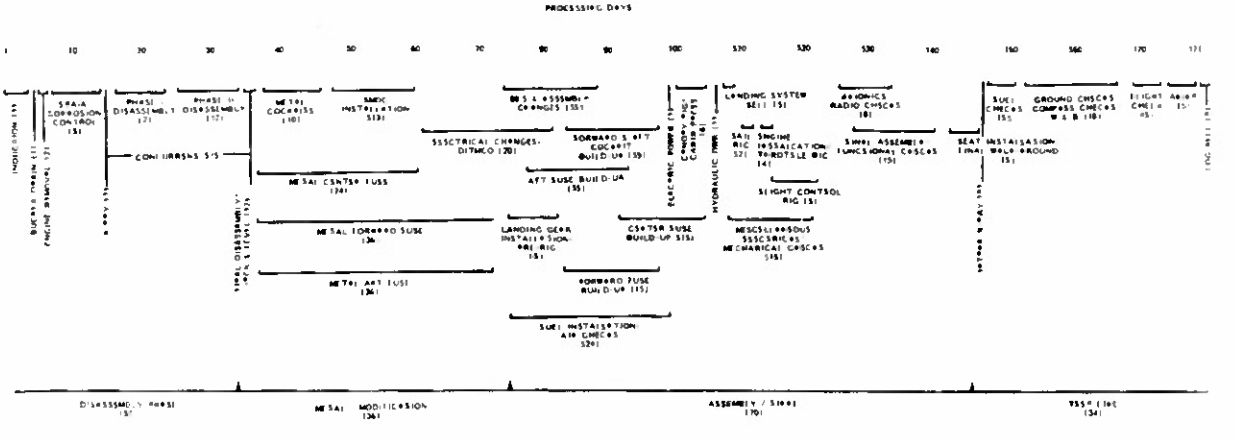

Figure 3. Post-GTST work flow.

REDESIGN OF PAPERWORK AND COMPUTER SUPPORT SYSTEMS

Concurrent with the identification of optimal work processes, the GTST team reviewed and modified the paperwork and computerized documentation required to support the overhaul of the F-14 to correspond to the work process revisions. The team wanted to create a system that would produce accurate documentation for work processes, that was inclusive in the sense that it could be used for the majority of cases, and that was comprehensive in that it tracked the aircraft from start to finish of overhaul. The processing paperwork was designed to contain options for documenting overhaul of the various models of F-14 aircraft. Tailoring the paperwork to each aircraft eliminated the need for many of the exceptions to the old processing form that were written by hand, appended to the packet of paperwork, and often not used to update other data bases (e.g., to update kitting lists and assembly instructions). The new paperwork, therefore, allowed for more work processes to be covered by preformatted, computer-generated documentation.

In the past, difficulties had arisen over incorrect parts numbers on the paperwork. For the post-GTST paperwork, all parts numbers were checked and updated before being listed. A new document was created, the Hardware Identification Card (HIC). This card indicated the type and number of pieces of hardware required for the various processes, and was used to inform the artisan of the hardware necessary for each operation and to help the artisan keep track of the hardware.

As a final point, the various paperwork and documentation systems were integrated, producing a more efficient, unified data base. Information from all phases of F-14 processing was stored in a common data base and personnel from the various functional areas had access to this base.

HOUSEKEEPING IN THE DISASSEMBLY AREA

The third major component of the GTST project, housekeeping, was performed throughout the course of the project and was focused on the disassembly phase of F-14 overhaul. Much of this work involved straightening up work areas and removing, discarding, or putting away excess materials. In many cases, the chaos and disorder in the disassembly area had been the result of backups in the work flow. The large number of components and parts in the disassembly area impeded the routine conduct of work. The reorganization of the work flow and general housekeeping in combination alleviated these difficulties.

Similarly, a smoother work flow through the Examination and Evaluation (E and E) area eliminated the backup of unprocessed parts and components. After GTST, it was possible to house two planes in disassembly rather than one. Further, the area for inspecting hardware, the parts storage area, a lunch table, and a room in which artisans could change clothes were all incorporated into the existing space (see Figures 4 and 5). The photographs on the following pages show the disassembly area before and after the GTST project (Figures 6 through 9).

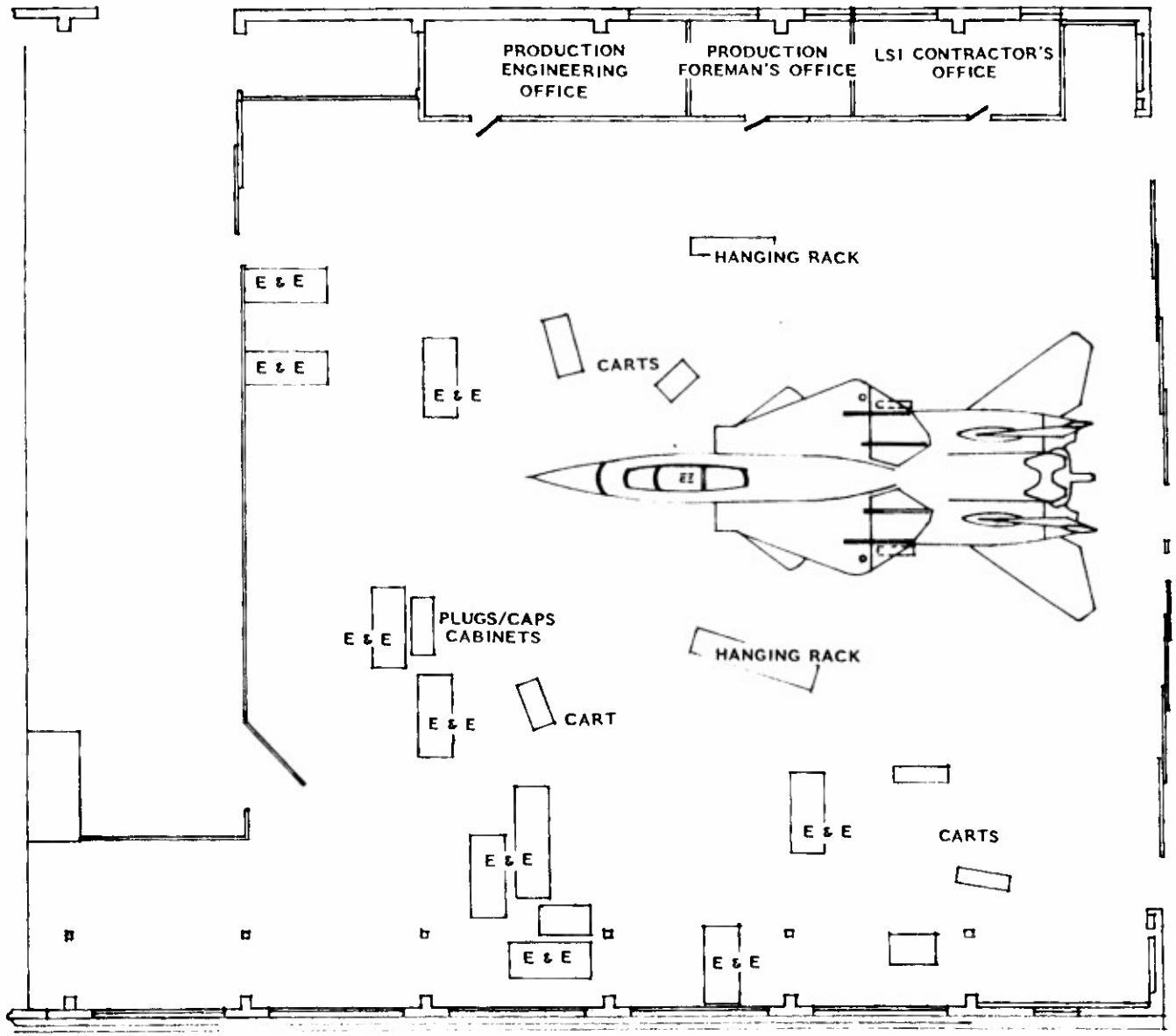

Figure 4. Pre-GTST floor plan of the disassembly area.

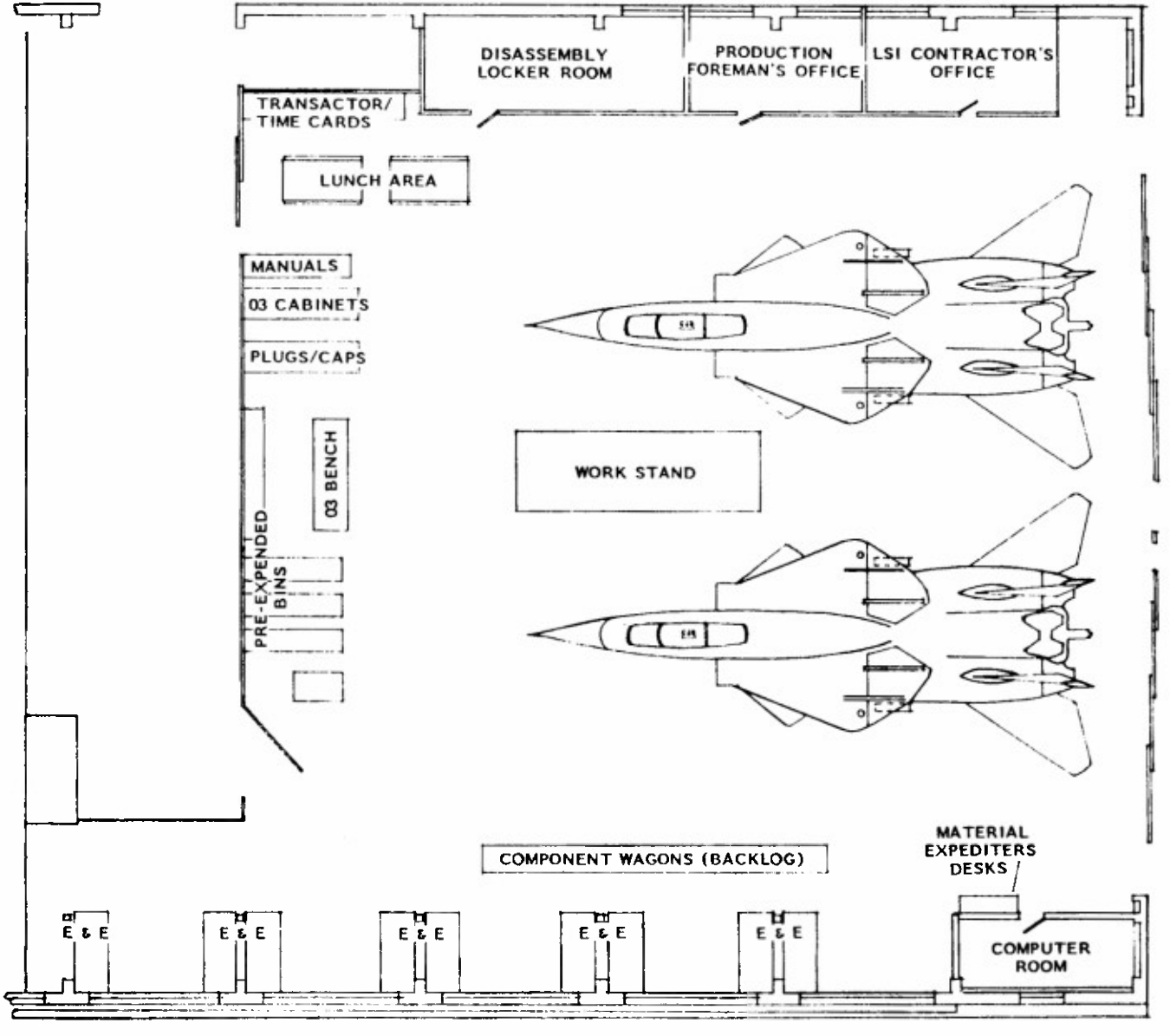

Figure 5. Post-GTST floor plan of the disassembly area.

Figure 6. Disassembly area before GTST, showing parts awaiting evaluation.

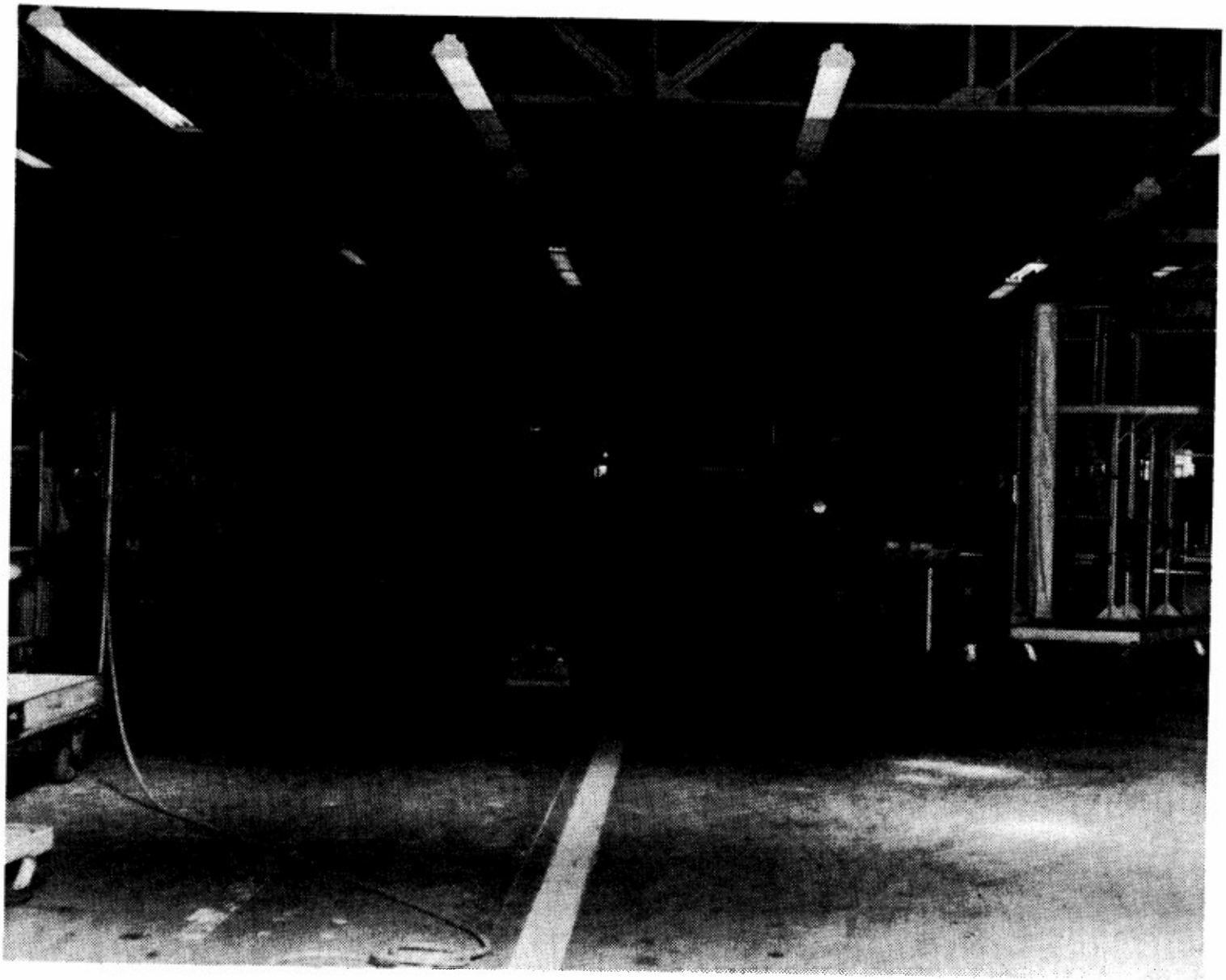

Figure 7. Another photograph of the disassembly area before GTST, showing disorganization in the area.

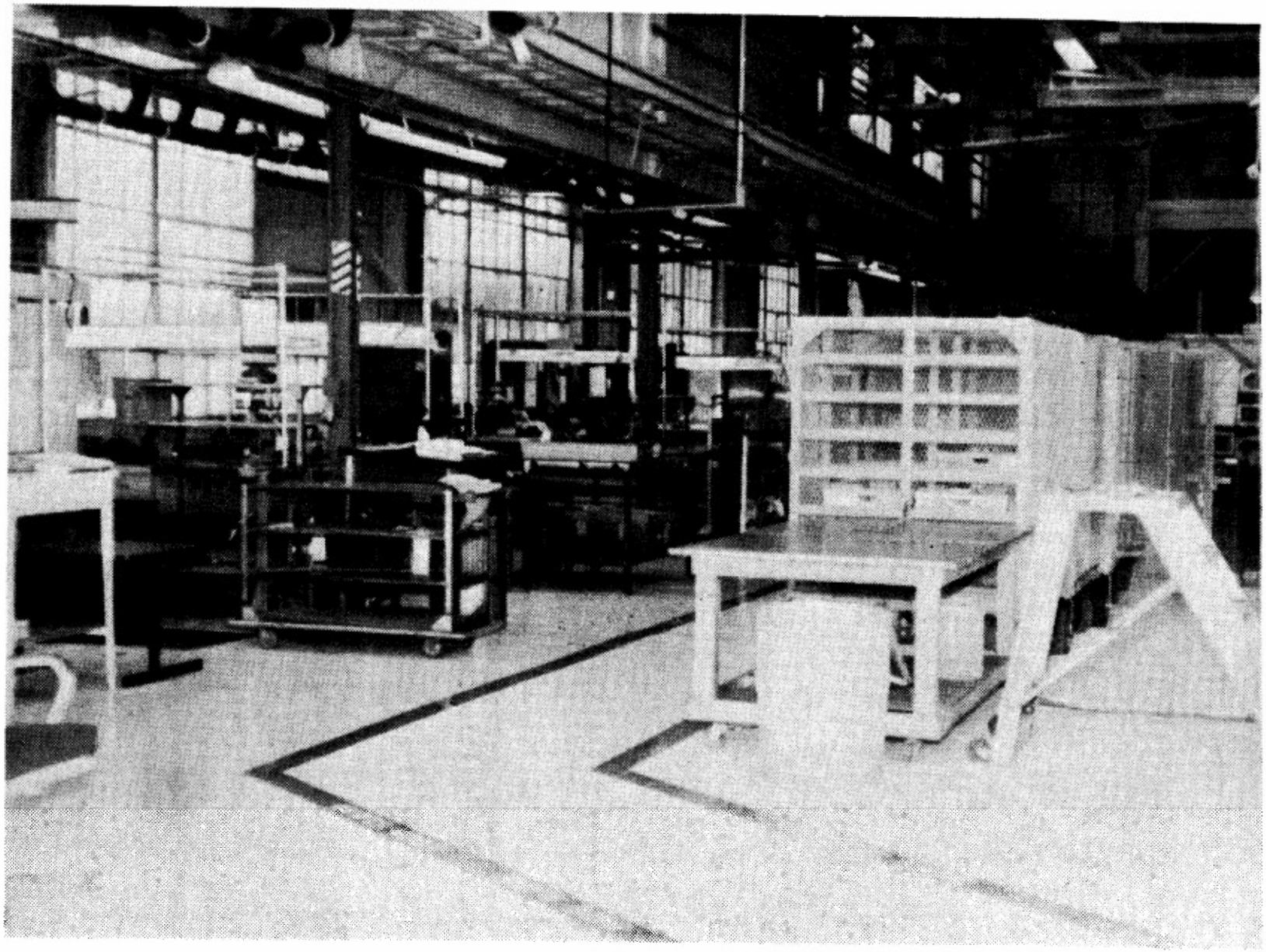

Figure 8. The disassembly area after GTST, indicating E & E area and cages for unevaluated parts/components.

Figure 9. Another view of the disassembly area after GTST, showing the pre-expended bins for hardware.

IMPLEMENTATION

The GTST project took place from 29 August 1985 to 28 February 1986. During this time the major tasks of the project described above were performed. At the completion of GTST, the new work procedures and paperwork were used to overhaul the F-14s awaiting processing.

Use of the work procedures and paperwork developed in the GTST project required changes in the way artisans performed their jobs. A certain period of adjustment was necessary for the artisans to accept the new system. Not only were the artisans asked to perform overhaul processes in a different manner, but their roles or job responsibilities were modified. For example, disassembly artisans were asked to evaluate hardware, and E & E artisans, rather than limited to evaluating a specific set of components (e.g., electrical parts), were now instructed to assess all types of components requiring evaluation.

The GTST project was carried out in a way that enhanced artisan acceptance of the new procedures. This was done in several ways: (1) people from the F-14 processing areas were on the GTST team; (2) frequent meetings and training sessions were held to inform all artisans of the new procedures and reasons for their use; and (3) members of the GTST team were present in the work areas when the GTST changes were implemented to help with the new processing system and observe how it worked in practice.

The GTST project not only provided a new conceptualization of how the F-14 can be overhauled, but also provided artisans with shop aids and procedures to facilitate their jobs. For example, a set of color photographs of parts and their identifying numbers was produced. The photographs are indexed both by part number and processing sequence number to enable artisans to properly identify parts and to attach the appropriate paperwork to each part. To help artisans with the performance of the routine task of entering information about F-14 processing into the computer system, bar codes and scanners are used to facilitate accurate and prompt entry of the information.

BENEFITS

The GTST project produced two types of benefits: (1) **process improvements,** which enabled artisans to perform their jobs more easily and efficiently, and (2) **outcome improvements,** which enhanced the overall operating efficiency of the F-14 program. Figure 10 lists the benefits of GTST and, in addition, describes the major components of the GTST project as well as the process and outcome improvements.

Process Improvements

The information about improvements resulting from GTST that are shown in Figure 10 was obtained from artisans, managers, and support groups. The redesign of work processes has produced a number of improvements. Parts that had been unnecessarily removed from the aircraft are no longer removed. Artisans and managers report that due to hardware control, less hardware is ordered, less time is spent in ordering hardware, and artisans spend less time looking for hardware. They report that the time to evaluate and route parts and components to feeder shops has been reduced due to improved work flow. Quicker processing of and greater control over parts and components have reduced backrobbing (taking parts/components from aircraft scheduled to be completed later in order to complete aircraft with pending deadlines). The improvements in the disassembly

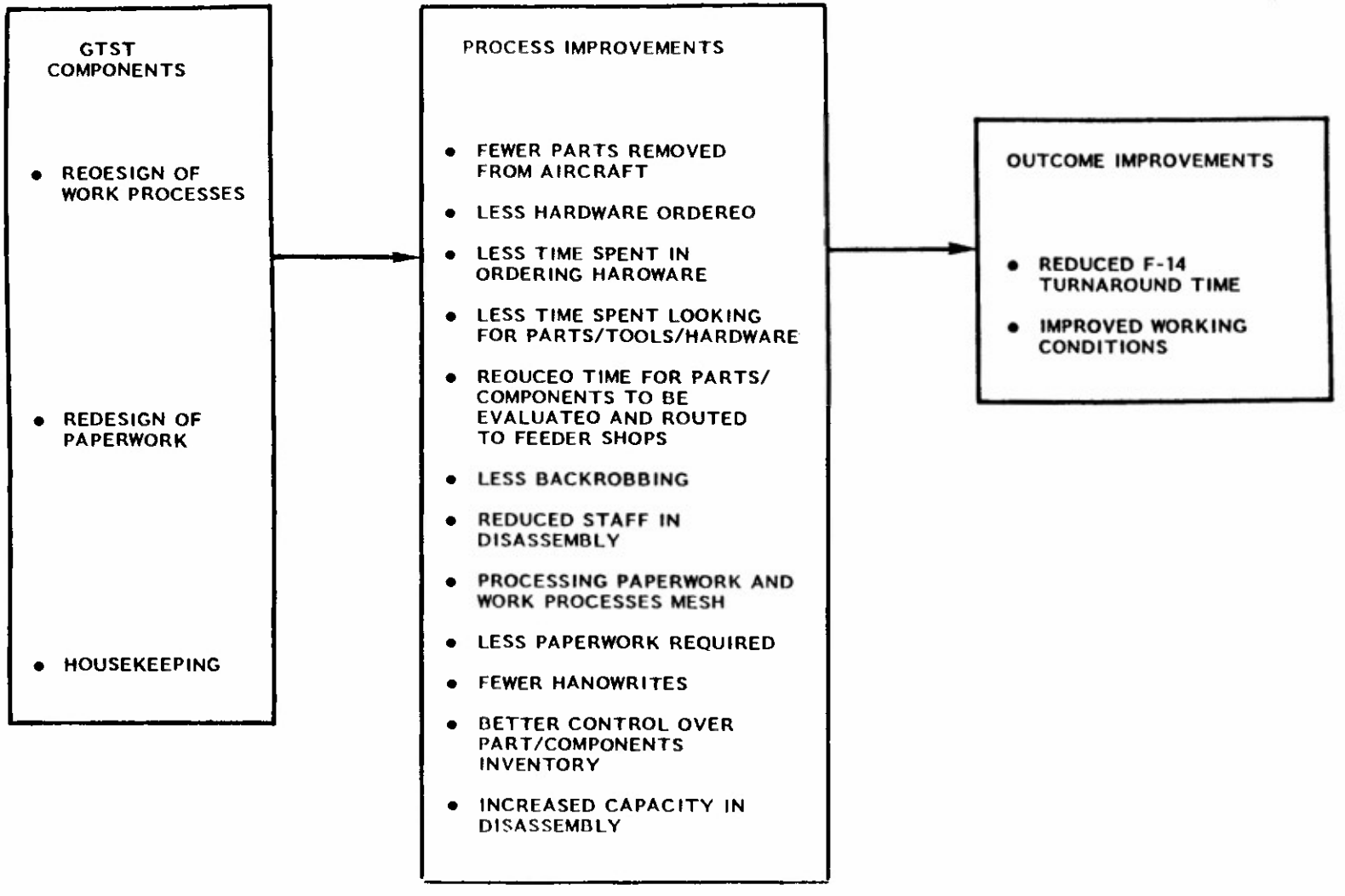

Figure 10. Summary of GTST components and of process and outcome improvements.

process have led to a reduction in staff, from 26 to 21 artisans, through transfer and attrition. Artisans report that the paperwork is easier to use because it more closely matches the work procedures they perform.

The redesign of the paperwork has decreased the amount of paperwork that is required for F-14 processing. Artisans write fewer exceptions (handwrites) to the computer-generated paperwork due to its increased accuracy. Material handling support staff report that better control is maintained over stored parts and components because part numbers are accurate and up-to-date. Due to housekeeping in disassembly, two airplanes rather than one can now be accommodated, allowing work to proceed on each simultaneously.

Outcome Improvements

It would appear that the benefits of GTST went beyond improvements at the operational level and produced a more efficient system overall. Initial findings indicate that turnaround time dramatically improved as a result of GTST. Comparison of data obtained prior to and after GTST shows that actual turnaround time in the disassembly phase was reduced from 26 to 21 days. In addition, artisans, managers, and support groups report improved working conditions due to greater control over work procedures and the ability to meet schedule efficiently. The redesign of the disassembly area has produced "quality of work life" benefits, such as a lunch area and locker room for artisans.

CONCLUSIONS

The GTST project was highly successful. Several aspects of the project were important to its overall success.

First, the project involved tackling an entire system--F-14 processing--for analysis and redesign. Previous attempts to improve outcomes in the program had focused on individual aspects of the program (e.g., hardware, paperwork) rather than the entire system. The clear focus of the GTST effort was to "do it right the first time," acknowledging that it may take more time initially to address system problems in order to realize payoffs down the line. The time, money, and disruption of schedule involved in the GTST project quickly paid off in improved system functioning after the project.

Second, the GTST team focused on redesigning the work processes and procedures within that system. This approach is dramatically different from other possible approaches to improving system output, such as putting more people on the job or exhorting people to do better work. The major tack was process improvement. By taking the "hands on" approach to redesigning the F-14 overhaul process, the GTST team learned all phases and aspects of the overhaul process. They were better able to identify areas where the system was not optimally working and to establish improvement in and control over it.

Third, the GTST team included people who do the work required to overhaul F-14s (e.g., disassembly artisans, material handlers), rather than just those who oversee it, such as managers and/or systems analysts. While the project team included many people not

formally trained in systems analysis or quality improvement, the practical approach adopted and the focus on work procedures enabled them to improve the system and identify ways to monitor it. In describing the GTST project, one of the leaders commented, "This shows what can be done when the working level is given the job of fixing a problem that they deal with day in and day out."

Fourth, the project would not have been successful without management support and commitment. Management gave the team the time, resources, and autonomy to systematically analyze the system. Further, management gave the team the authority to enact changes to improve the system and then backed the team in those changes. This point cannot be overemphasized. As one of the GTST leaders pointed out, "When upper management recognizes and understands the need of such a project, provides all the necessary backing and support but stays out of the solution process, any problem can be resolved at the appropriate lower level."

FINAL REMARKS

While the GTST project has been successful, it is only a beginning and part of an effort to continuously improve processes. The GTST project focused on the disassembly phase of F-14 processing, and there are plans to work on other phases (e.g., overhaul of parts/components in processing feeder shops). In order to continue to improve the system and to hold the gains made to date, it will be necessary to measure and monitor the system to see the effect of changes and identify other areas of improvement. Such an effort is currently underway in disassembly (i.e., a system to monitor paperwork processing) and can serve as a model for other phases in F-14 processing.

As stated at the outset, the aims of this report were to demonstrate the value of focusing on process to improve an overall operation, to provide examples of the process changes made, and to describe the role of management as a provider of support, guidance, and resources for such an undertaking. This information was useful in arriving at conclusions about the present status of this effort. The information may be equally important in providing recommended strategies for other organizations with similar problems, whether or not they involve personnel functions or manufacture of products.

APPENDIX

GTST TEAM LEADERS

GTST TEAM LEADERS

Three individuals emerged as the driving force behind the GTST project. Brief descriptions of their positions at NAVAVNDEPOT, North Island and their involvement in the project follow.

The F-14 project manager had perhaps the greatest investment in seeing the F-14 processing system improved, since he is the individual responsible for meeting schedule for processing the aircraft. He started at NAVAVNDEPOT, North Island in 1966 as an artisan, functioned as an operations analyst, and worked his way up to the level of program manager. In his role as F-14 program manager, he negotiates the F-14 workload and serves as a liaison between NAVAVNDEPOT, North Island and the Fleet. His position and authority as a program head require him to interact with top management from all departments at NAVAVNDEPOT, North Island.

The second individual who served as a leader of the GTST project was a member of the Long Range Material Planning Department. In that position he works closely with capability planners to develop material support for aircraft processing, usually 1 year in advance of the need. He started at NAVAVNDEPOT, North Island in 1973 as a shop production controlman, responsible for supplying the shop with parts, components, and hardware for assembling the F-4.

The third key member of the GTST team was a production foreman from the F-14 assembly area. He began work at NAVAVNDEPOT, North Island in 1961 as an aircraft electrical worker. He has 19 years of experience on the flight line and was recognized as Artisan of the Year in 1979. He was promoted to foreman in 1981, and currently works in the Flight Line Division.

THE GTST TEAM

Management Controls Department, Operating Systems Branch
- Shara Guarnes

Quality and Reliability Assurance Department
- George Lattuca

Production Planning and Inventory Control Department
- William Hines
- John Orrell
- Robert Karlin
- Dorthy Gonzalas
- Steven King

Production Engineering Department, Accessories and Components Branch
- Gerald Telles
- Charles Rose

Production Engineering Department, Aircraft and Engine Branch
- Richard Perez
- Donald Smith
- Charles Schutza
- Linus Pusson
- Ronald Evans
- E. J. Moriel
- Robert Kinipple
- Chuck Cameron
- Cynthia Guerrero

Production Engineering Department, Methods and Standards Division
- James Stephenson
- Leon Halgunseth
- Howdiel Baloy

Material Department, Material Systems Planning Branch
- Charles T. Omelina

Production Department, Aircraft Division
- Charlie Ross
- Marn Archuleta
- D'Wayne Avila
- Oriville Fike
- William Hultz
- T. O. Kelley
- John Lavullis
- Dennis McIntosh
- Raymond Randome
- Charles Slaughter
- Dennis Wolf